

CLAIMS

1. A pellet-shaped article inspection unit configured for use with a conveyer mechanism structured to convey a plurality of pellet-shaped articles along a predetermined path, the article inspection unit comprising:

a first camera unit positioned adjacent a first side of the conveyer mechanism, the first camera unit being configured to sense a first predetermined characteristic of the plurality of pellet-shaped articles; and

a removal mechanism, downstream from the first camera unit, structured to remove at least a selected one of the plurality of pellet-shaped articles from at least a selected portion of the conveyer mechanism depending on whether the first predetermined characteristic is sensed by the first camera unit.

2. The pellet-shaped article inspection unit according to claim 1, further comprising a controller in communication with the first camera unit and the removal mechanism, the controller providing a signal to the removal mechanism in accordance with the first predetermined characteristic sensed by the first camera unit.

3. The pellet-shaped article inspection unit according to claim 2, further comprising a second camera unit positioned adjacent a second side of the conveyer mechanism, the second camera unit being configured to sense a second predetermined characteristic of the plurality of pellet-shaped articles.

4. The pellet-shaped article inspection unit according to claim 3, wherein the first camera unit senses a first side of the pellet-shaped article for the first predetermined characteristic and the second camera unit senses a second side of the pellet-shaped article for the second predetermined characteristic.

5. The pellet-shaped article inspection unit according to claim 4, wherein the first predetermined characteristic is the same as the second predetermined characteristic.

6. The pellet-shaped article inspection unit according to claim 4, wherein the first and second sides are first and second sides of a tablet.

7. The pellet-shaped article inspection unit according to claim 3, wherein each of the first and second camera units includes a ring light having an opening

therethrough, a lens extending through the opening, and a black/white 1/3 CCD coupled to the lens.

8. The pellet-shaped article inspection unit according to claim 3, wherein the first camera unit is positioned transverse to and on an upper side of the conveyer mechanism to sense a first side of the pellet-shaped article and the second camera unit is positioned transverse to and on an inner side of the conveyer mechanism to sense a second side of the pellet-shaped article through a throughhole.

9. The pellet-shaped article inspection unit according to claim 3, wherein the controller signals the removal mechanism in accordance with the predetermined characteristic sensed by at least one of the first and second camera units.

10. The pellet-shaped article inspection unit according to claim 3, wherein the first predetermined characteristic sensed by the first camera unit is the same as the second predetermined characteristic sensed by the second camera unit.

11. The pellet-shaped article inspection unit according to claim 3, wherein each of the first and second camera units senses a plurality of pellet-shaped articles simultaneously.

12. The pellet-shaped article inspection unit according to claim 11, wherein each of the first and second camera units sense at least four pellet-shaped articles simultaneously.

13. The pellet-shaped article inspection unit according to claim 1, wherein the first predetermined characteristic is at least one of a predetermined color and a predetermined indicia.

14. The pellet-shaped article inspection unit according to claim 1, wherein the first predetermined characteristic includes a predetermined color and a predetermined indicia.

15. The pellet-shaped article inspection unit according to claim 1, wherein the removal mechanism is a blower.

16. The pellet-shaped article inspection unit according to claim 15, wherein the blower includes a plurality of blower nozzles that is equal to a number of pockets in each carrier bar.

17. A pellet-shaped article conveying apparatus comprising:
a conveyer mechanism structured to convey a plurality of pellet-shaped articles along a predetermined path; and
a first camera unit positioned on an inner side of the conveyer mechanism, the first camera unit being configured to sense a first side of the plurality of pellet-shaped articles for a first predetermined characteristic,
wherein the conveyer mechanism has at least one throughhole configured to allow the first camera unit to sense the first side of the pellet-shaped article that is visible through the throughhole.

18. The pellet-shaped article conveying apparatus according to claim 17, wherein the conveyer mechanism includes a plurality of carrier bars each having a plurality of pockets for receiving a plurality of pellet-shaped articles, each pocket having one said throughhole configured to allow the first camera unit to sense the first side of the pellet-shaped article that is visible through the throughhole.

19. The pellet-shaped article conveying apparatus according to claim 18, further comprising a removal mechanism, downstream from the first camera unit, structured to remove at least a selected one of the plurality of pellet-shaped articles from at least a selected one of the plurality of carrier bars depending on whether the first predetermined characteristic is sensed by the first camera unit.

20. The pellet-shaped article conveying apparatus according to claim 19, further comprising a controller in communication with the first camera unit and the removal mechanism, the controller providing a signal to the removal mechanism in accordance with the first predetermined characteristic sensed by the first camera unit.

21. The pellet-shaped article conveying apparatus according to claim 20, further comprising a second camera unit positioned transverse to the carrier bars on an

upper side of the conveyer mechanism, the second camera unit being configured to sense a second side of the pellet-shaped articles for a second predetermined characteristic.

22. The pellet-shaped article conveying apparatus according to claim 21, wherein the first predetermined characteristic is the same as the second predetermined characteristic.

23. The pellet-shaped article conveying apparatus according to claim 21, wherein the first and second sides are first and second sides of a tablet.

24. The pellet-shaped article conveying apparatus according to claim 21, wherein each of the first and second camera units includes a ring light having an opening therethrough, a lens extending through the opening, and a black/white or color 1/3 CCD coupled to the lens.

25. The pellet-shaped article conveying apparatus according to claim 21, wherein the controller signals the removal mechanism in accordance with the predetermined characteristic sensed by at least one of the first and second camera units.

26. The pellet-shaped article conveying apparatus according to claim 19, wherein the throughhole is configured to allow the removal mechanism to pass therethrough to thereby remove the selected pellet-shaped article from that pocket in the carrier bar.

27. The pellet-shaped article conveying apparatus according to claim 19, wherein the removal mechanism is a blower.

28. The pellet-shaped article conveying apparatus according to claim 17, wherein the first side includes first and second ends of a caplet.

29. The pellet-shaped article conveying apparatus according to claim 17, wherein the first predetermined characteristic is at least one of a predetermined color and a predetermined indicia.

30. The pellet-shaped article conveying apparatus according to claim 17, wherein the first predetermined characteristic includes a predetermined color and a predetermined indicia.

31. The pellet-shaped article conveying apparatus according to claim 17, wherein the first camera unit is configured to sense the first predetermined characteristic and a second predetermined characteristic.

32. A conveyer apparatus comprising:
a conveyer mechanism including a plurality of carrier bars, each carrier bar being structured to convey a plurality of pellet-shaped articles along a predetermined path;
a first camera unit positioned adjacent a first side of the conveyer mechanism, the first camera unit being configured to sense a first predetermined characteristic of the plurality of pellet-shaped articles; and
a removal mechanism, downstream from the first camera unit, structured to remove at least a selected one of the plurality of pellet-shaped articles from at least a selected one of the plurality of carrier bars depending on whether the first predetermined characteristic is sensed by the first camera unit.

33. The conveyer apparatus according to claim 32, further comprising a controller in communication with the first camera unit and the removal mechanism, the controller providing a signal to the removal mechanism in accordance with the first predetermined characteristic sensed by the first camera unit.

34. The conveyer apparatus according to claim 33, further comprising a second camera unit positioned adjacent a second side of the conveyer mechanism, the second camera unit being configured to sense a second predetermined characteristic of the plurality of pellet-shaped articles.

35. The conveyer apparatus according to claim 34, wherein the first camera unit senses a first side of the pellet-shaped article for the first predetermined characteristic and the second camera unit senses a second side of the pellet-shaped article for the second predetermined characteristic.

36. The conveyer apparatus according to claim 35, wherein the first predetermined characteristic is the same as the second predetermined characteristic.

37. The conveyer apparatus according to claim 35, wherein the first and second sides are first and second sides of a tablet.

38. The conveyer apparatus according to claim 34, wherein each of the first and second camera units includes a ring light having an opening therethrough, a lens extending through the opening, and a black/white or color 1/3 CCD coupled to the lens.

39. The conveyer apparatus according to claim 34, wherein the first camera unit is positioned transverse to the carrier bars on an upper side of the conveyer mechanism to sense a first side of the pellet-shaped article and the second camera unit is positioned transverse to the carrier bars on an inner side of the conveyer mechanism to sense a second side of the pellet-shaped article through the throughhole.

40. The conveyer apparatus according to claim 34, wherein the controller signals the removal mechanism in accordance with the predetermined characteristic sensed by at least one of the first and second camera units.

41. The conveyer apparatus according to claim 34, wherein the first predetermined characteristic sensed by the first camera unit is the same as the second predetermined characteristic sensed by the second camera unit.

42. The conveyer apparatus according to claim 34, wherein each of the first and second camera units senses a plurality of pellet-shaped articles simultaneously.

43. The conveyer apparatus according to claim 42, wherein each of the first and second camera units sense up to four pellet-shaped articles simultaneously.

44. The conveyer apparatus according to claim 32, wherein the first predetermined characteristic is at least one of a predetermined color and a predetermined indicia.

45. The conveyer apparatus according to claim 32, wherein the first predetermined characteristic includes a predetermined color and a predetermined indicia.

46. The conveyer apparatus according to claim 32, wherein the removal mechanism is a blower.

47. The conveyer apparatus according to claim 46, wherein the blower includes a plurality of blower nozzles that is equal to a number of pockets in each carrier bar.

48. A pellet-shaped article inspection unit configured for use with a conveyer mechanism including a plurality of carrier bars, each carrier bar being structured to convey at least one pellet-shaped article along a predetermined path, the article inspection unit comprising:

a first camera unit positioned adjacent a first side of the conveyer mechanism, the first camera unit being configured to sense a first predetermined characteristic of the pellet-shaped article and a second predetermined characteristic of the of pellet-shaped article, the first and second predetermined characteristics being different from one another; and

a removal mechanism, downstream from the first camera unit, structured to remove the pellet-shaped article from at least a selected one of the plurality of carrier bars depending on whether at least one of the first and second predetermined characteristics is sensed by the first camera unit.

49. The pellet-shaped article inspection unit according to claim 48, further comprising a controller in communication with the first camera unit and the removal mechanism, the controller providing a signal to the removal mechanism in accordance with the first and second predetermined characteristics sensed by the first camera unit.

50. The pellet-shaped article inspection unit according to claim 49, further comprising a second camera unit positioned adjacent a second side of the conveyer mechanism, the second camera unit being configured to sense a third predetermined characteristic of the pellet-shaped article.

51. The pellet-shaped article inspection unit according to claim 50, wherein the first camera unit senses a first side of the pellet-shaped article for the first and second predetermined characteristics and the second camera unit senses a second side of the pellet-shaped article for the third predetermined characteristic.

52. The pellet-shaped article inspection unit according to claim 51, wherein the third predetermined characteristic is the same as one of the first and second predetermined characteristics.

53. The pellet-shaped article inspection unit according to claim 51, wherein the first and second sides are first and second sides of a tablet.

54. The pellet-shaped article inspection unit according to claim 50, wherein each of the first and second camera units includes a ring light having an opening therethrough, a lens extending through the opening, and a black/white 1/3 CCD coupled to the lens.

55. The pellet-shaped article inspection unit according to claim 50, wherein the first camera unit is positioned transverse to the carrier bars on an upper side of the conveyer mechanism to sense a first side of the pellet-shaped article and the second camera unit is positioned transverse to the carrier bars on an inner side of the conveyer mechanism to sense a second side of the pellet-shaped article through a throughhole of each of the carrier bars.

56. The pellet-shaped article inspection unit according to claim 50, wherein the controller signals the removal mechanism in accordance with the predetermined characteristic sensed by at least one of the first and second camera units.

57. The pellet-shaped article inspection unit according to claim 50, wherein each of the first and second camera units senses a plurality of pellet-shaped articles simultaneously.

58. The pellet-shaped article inspection unit according to claim 57, wherein each of the first and second camera units sense up to four pellet-shaped articles simultaneously.

59. The pellet-shaped article inspection unit according to claim 48, wherein the first predetermined characteristic is one of a predetermined color and a predetermined indicia and the second predetermined characteristic is the other of the predetermined color and the predetermined indicia.

60. The pellet-shaped article inspection unit according to claim 48, wherein the removal mechanism is a blower.

61. The pellet-shaped article inspection unit according to claim 60, wherein the blower includes a plurality of blower nozzles that is equal to a number of pockets in each carrier bar.

62. A method of inspecting pellet-shaped articles structured for use with a conveyer mechanism including a plurality of carrier bars, each carrier bar structured to convey a plurality of pellet-shaped articles along a predetermined path, the method comprising:

sensing at least one side of the plurality of pellet-shaped articles for a predetermined characteristic; and

removing at least a selected one of the plurality of pellet-shaped articles from at least a selected one of the plurality of carrier bars depending on whether the predetermined characteristic is sensed.

63. The method according to claim 62, further comprising sensing a first side of the pellet-shaped article for a first predetermined characteristic and sensing a second side of the pellet-shaped article for a second predetermined characteristic.

64. A carrier bar for a conveyer mechanism that conveys a plurality of pellet-shaped articles along a predetermined path past an inspection unit having at least one camera unit and a removal mechanism, the carrier bar comprising:

a plurality of pockets for receiving a plurality of pellet-shaped articles, each of the pockets having a throughhole configured to allow (1) the at least one camera unit to view the pellet-shaped article, and (2) the removal mechanism to remove the pellet-shaped article from that pocket in the carrier bar.

65. The carrier bar according to claim 64, wherein the plurality of pockets are staggered along a length of the carrier bar.

66. The carrier bar according to claim 64, wherein edges of the carrier bar are scalloped.

67. The carrier bar according to claim 64, wherein the throughhole substantially matches a shape of the pellet-shaped articles.

68. The carrier bar according to claim 64, wherein each pocket includes an article-retaining flange that extends inwardly from an exterior wall of the pocket and wherein an inner peripheral surface of the flange defines the throughhole.

69. The carrier bar according to claim 64, wherein the plurality of pockets and throughholes thereof are positioned within a thickness of the carrier bars.

70. A carrier bar assembly comprising:
a first carrier bar and a second carrier bar, each of the first and second carrier bars including:

a main body including an upper surface; and
a plurality of pockets formed in the upper surface, each of the pockets being configured to receive a pellet-shaped article;
wherein the pockets of the first carrier bar are staggered with respect to adjacent pockets of the second carrier bar, and
wherein each pocket of the first and second carrier bars includes a throughhole configured to allow a camera unit to sense a side of the pellet-shaped article that is visible through the throughhole.

71. The carrier bar assembly according to claim 70, wherein the throughhole is configured to allow a removal mechanism to remove the pellet-shaped article from that pocket in the carrier bar.

72. The carrier bar assembly according to claim 70, wherein the first and second carrier bars have scalloped edges.

73. The carrier bar assembly according to claim 70, wherein the throughhole substantially matches a shape of the pellet-shaped articles.

74. The carrier bar assembly according to claim 70, wherein each pocket includes an article-retaining flange that extends inwardly from an exterior wall of the pocket and wherein an inner peripheral surface of the flange defines the throughhole.

75. The carrier bar assembly according to claim 70, wherein the plurality of pockets and throughholes thereof are positioned within a thickness of the carrier bars.

76. A carrier bar assembly comprising:

at least first and second adjacent carrier bars, each of the first and second carrier bars including an upper surface including at least one scalloped edge, the scalloped edge of the first carrier bar being cooperable with the scalloped edge of the second carrier bar to form a substantially continuous surface; and

a plurality of pockets formed in the upper surface, each of the pockets being configured to receive a pellet-shaped article;

wherein each pocket of the first and second carrier bars includes a throughhole configured to allow a camera unit to sense a side of the pellet-shaped article that is visible through the throughhole.

77. The carrier bar assembly according to claim 76, wherein the pockets of the first carrier bar are staggered with respect to adjacent pockets of the second carrier bar.

78. The carrier bar assembly according to claim 76, wherein the throughhole is configured to allow a removal mechanism to remove the pellet-shaped article from that pocket in the carrier bar.

79. The carrier bar assembly according to claim 76, wherein the throughhole substantially matches a shape of the pellet-shaped articles.

80. The carrier bar assembly according to claim 76, wherein each pocket includes an article-retaining flange that extends inwardly from an exterior wall of the pocket and wherein an inner peripheral surface of the flange defines the throughhole.

81. The carrier bar assembly according to claim 76, wherein the plurality of pockets and throughholes thereof are positioned within a thickness of the carrier bars.

82. A camera unit for sensing a plurality of pellet-shaped articles on a conveyer mechanism comprising:

a ring light having an opening therethrough;

a lens extending through the opening; and

a black/white or color 1/3 CCD coupled to the lens.

83. The camera unit according to claim 82, wherein the lens includes a filter.

84. The camera unit according to claim 82, wherein the camera unit is mountable to a mounting bracket that is adjustable relative to the conveyer mechanism.

85. An apparatus for inspecting a predetermined characteristic of a pellet shaped article, comprising:

- a conveyer loop to convey at least one row of articles along a transport path;
- an inspection unit to compare the predetermined characteristic against a given standard; and

- a reject system to forcibly eject from the conveyer selected ones of the articles which are acceptable, and to passively allow rejected ones of the articles to be removed from the conveyer.

86. A method for inspecting a predetermined characteristic of a pellet shaped article, comprising:

- conveying at least one row of articles along a transport path;
- comparing the predetermined characteristic against a given standard;
- actively accepting selected ones of the articles which are acceptable by forcing them away from the transport path; and
- passively allowing rejected ones of the articles to be removed from the transport path.

87. A laser drilling system for pellet-shaped articles comprising:

- a laser; and
- a controller to allow the laser to create at least one laser drilled hole in the articles having a diameter spanning a range from about 50 micrometers to about 6 mm.

88. The laser drilling system of claim 87, wherein the range is about 50 micrometers to 1 mm for relatively large holes, and about 1 mm to about 6 mm for relatively larger holes.

89. A laser drilling system for pellet-shaped articles comprising:

- a laser to create a laser beam;
- a deflector to deflect the laser beam; and

a controller to allow the deflector to split the laser beam into a plurality of axially spaced rows.

90. An apparatus for conveying pellet-shaped articles comprising:
a conveyer to transport a plurality of articles; and
a laser drilling system according to claim 87.

91. A pharmaceutical article comprising:
a main body with a medicament surrounded by a coating; and
at least one hole provided through the main body to allow the medicament to pass through the coating, wherein the at least one hole has a diameter of over 800 micrometers.

92. The article of claim 91, wherein the diameter is between about 3-6 mm.

93. A method for making a pharmaceutical article, such as tablets and caplets, comprising providing a laser drilled hole in the article which is greater than 800 micrometers.

94. The method of claim 93, wherein the diameter is about 1 mm-6 mm.

95. The method of claim 93, wherein the hole is created using a laser with a beam having a nominal diameter of about 400-800 micrometers.

96. The method of claim 95, wherein the laser beam from the laser is redirected in a plurality of positions on the article to circumscribe a pattern defining and forming the hole.